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ABSTRACT

Part of a series of curriculum guides dealing with industrial education in junior high schools, this guide provides the student with information and manipulative experiences on small gasoline engines. Included are sections on shop adjustment, safety, small engines, internal combustion, engine construction, four stroke engines, two stroke engines, a comparison of two and four stroke engines, rotary engines, identifying markings on engines, cooling systems, air cleaners, fuel strainers, crankcases, lubrication, fuel selection, spark plugs, carburetor adjustment, compression, batteries, starting the engines, engine adjustments, storing lawn movers, starter systems, ignition systems, and fuel systems. For each unit, objectives are provided as well as lists of learning activities, equipment needed, and resource materials. The types of activities include field trips, class discussions, research reports, demonstrations, problem solving, and the actual use and care of equipment. (HLG)

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SMALL GASOLINE ENGINES - OPERATION, CONSTRUCTION, CARE, and MAINTENANCE

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EDUCATIONAL GOALS

SMALL ENGINES

INTRODUCTION

Small engines is an elective course offered to boys and girls in the junior high schools and will give the students an opportunity to study the many careers closely allied to small gasoline engines.

Small engines is exploratory in nature. The student will spend time studying the construction, operation, care and maintenance of the small gasoline engine. Through manipulative experiences with the various components such as carburator, ignition, cooling, and lubrication, the students will have the opportunity to learn how they are constructed and how they relate to each other working as a unit.

UNIT 1

Small Gasoline Engines, Operation, Construction, Care and Maintenance.

Orientation - Shop Adjustment.

OBJECTIVES

Given a picture or drawing of all tools and equipment to be used on small engines,

1. The pupil will identify each.
2. The pupil will demonstrate during the six weeks how to correctly use the tools and equipment.
3. The pupil will explain acceptable methods of caring for the tools and equipment.

ACTIVITIES

1. Discuss: Types of tools and equipment found in the small engine section of the shop.
2. Demonstrate: Correct procedures in selecting and using tools and machines.
3. Collect: Information about other tools and machines that may be found in a small engine repair shop.

OBJECTIVES

4. The pupil will know the areas and limits of his activity while in the shop.
5. The pupil will practice good work habits while in the shop.
6. The pupil will assume a part of the responsibility for clean-up in the shop.

1. Set: Up rules for students to follow when working in the laboratory.
2. Demonstrate: The work techniques practiced in the trade:
   1. Care of work space.
   2. Care of tools.
   3. Care of disassembled engine and parts.
   4. Care of shop.
   5. Storage of engine and parts.
3. Assign: Students to different jobs concerning clean-up procedures. Set up on a rotating basis so pupils will have experience in all phases of clean-up.

4. Make: Signs to display in room to make students aware of importance of shop rules and procedures.

MATERIALS

Parma Schools Safety Program (76-77) passouts
1. Characteristics of a Good Workman
2. Power mower safety

BOOK: "Small Engines", Vol. 2, AUIM, pp. 5-7.

UNIT 2

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Orientation - Snop Safety

OBJECTIVES

1. The pupil will demonstrate a knowledge of safety procedures in the snop by:
    1. Passing a general safety test, or safety tests designed for the units or activities.
    2. Demonstrate safe working practices through the entire course.
2. The pupil will list causes of accidents.
3. The pupil will watch for un-safe conditions and report them immediately to the instructor.

ACTIVITIES

1. Discuss: The causes of accidents in a lab situation.
2. Students evaluate: Lab and students work in the laboratory. Make recommendations to class for improving work habits, practices, and snop maintenance.
3. Discuss: Personal safety devices:
    1. Eye protection
    2. Clothing
    3. Gloves
4. Discuss: Handling of gasoline and other flamables, and the location of and use of the fire extinguishers.
5. Discuss: Evaluation of room and other steps to be taken in event of an emergency or fire drill.

MATERIALS

Parma Schools safety program - passouts
1. Self analysis quiz
2. Safety Wednesday
3. Bulletin board
4. Student safety agreement
5. Goggles

UNIT 3

Small Gasoline, Operation, Construction, Care, and Maintenance.

Principles of Operation - Distinguishing Features

Given examples of engines that are two and four-cycle, engines with vertical and horizontal crankshafts, and engines made of different materials.

OBJECTIVES

1. The pupil will distinguisn between the two and four-cycle engines from the outward differences.
2. The pupil will distinguisn between the operating positions of the crankshaft.
3. The pupil will distinguisn between differences in size (horsepower) by explaining to the class.
4. The pupil will distinguisn between the differences in materials used in making the cylinder block.
5. _____
6. _____

ACTIVITIES

1. Discuss: General reasons for outward difference in the two and four-cycle engines.
2. Discuss: Different positions of the cranksnaft.
3. List: Several macnines requiring a horizontal crankshaft, and several machines requiring a vertical cranksnaft.
4. Discuss: Different materials that the engine block could be made of.
5. Demonstrate: The meaning of horsepower, and the use of the Horsepower formula.
6. Solve: Simple problems in horsepower.
7. Small Groups: Divide by random selection, could work out their solutions to the above problems, and each group leader could report to class for discussion or debate.

MATERIALS

Book: Small Engines, American Association for Vocational Instructional Materials, Vol. I, pp. 7-10.

UNIT 4

Small Gasoline, Operation, Construction, Care, and Maintenance.

Principles of Operation - The Internal Combustion Engine

Given a cut-a-way drawing of an assembled engine block.

OBJECTIVES

1. The pupil will explain the basic theory of the internal combustion engine.
2. _____

ACTIVITIES

1. Discuss: Advantages of internal combustion engines over steam power or electric motor power for machines.
2. Discuss: Disadvantages of the internal combustion engine.
3. Discuss: Solutions to today's problems of polution and fuel shortages.
4. Assign: Special reports concerning a brief History of the development of the internal combustion engine. Include:

    1. Early steam engine
    2. Steam turbine
    3. Early attempts at internal combustion engines
    4. Present engines and refinements

    Assign special reports on men important to the development of the internal combustion engine:

    1. Christian Huygens
    2. Philip Lebon
    3. Samuel Brown
    4. William Barnett
    5. Pierre Lenoir
    6. Beau DeRochas
    7. Dr. N. A. Otto
    8. Atkinson
    9. Gottlieb
    10. Daimler
    11. Priestman and Hall
    12. Herbert Akroyd Stuart
    13. Rudolph Diesel

MATERIALS

Book: "Power Mechanics", Pat H. Atteberry, Goodheart-Willcox, Homewood, Illinois, 1968, pp. 4-15.

Slides: Understanding Horsepower and torque, Jacobsen service training Program No. 1.

UNIT 5

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Principles of Operation - Engine Construction.

Given a cut-away drawing of a four-cycle engine,

OBJECTIVES

1. The pupil will list the names of the parts and match them to indicate ones on the drawing.
2. The pupil will describe and give the function or purpose of each of the parts.
3. _____
4. _____

ACTIVITIES

1. Discuss: Using cut-away drawing and model, name and explain each of the parts.
2. Review: By having students take turns naming the different parts.
3. Discuss: Events in the engine that gets it running and keeps it running.
4. Discuss: Bore, BDC, TDC, and piston displacement.
5. Discuss: Importance of Gaskets and need to replace them.
6. Demonstrate: Using a disassembled engine, connecting piston, connecting rod, and crankshaft to illustrate how reciprocating motion is converted to rotary motion.
7. Demonstrate: Using a crankshaft and a camshaft, point out timing marks.
8. Demonstrate: By removing the cylinder head of a four-cycle engine, rotate the crankshaft, and observe the action of the valves.

MATERIALS

Transparencies, Parma City Schools, prepared transparencies and wall chart photos.

UNIT 6

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Principles of Operation - Four-stroke cycle engine.

OBJECTIVES

Given a cut-away model of a four-stroke cycle engine and/or a cut-away drawing,

1. The pupil will list and define the four events in the operating cycles of a four-cycle engine.
2. _____

ACTIVITIES

1. Discuss: The theory of the four-cycle engine.
2. Demonstrate: On a cut-away model of the four-cycle engine the different events taking place on each stroke.
3. Define: 1. a stroke
   2. a revolution
4. List: The Advantages of the four-stroke cycle engine.

MATERIALS

Book: "Small Engines", Vol. I, AAVIM, pp. 11-13.

UNIT 7

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Principles of Operation - Two-stroke cycle engine.

OBJECTIVES

Given a cut-away model of a two-stroke cycle engine and/or a cut-away drawing,

1. The pupil will list and define the events that take place in a complete operating cycle of a two-cycle engine.
2. _____
3. _____
4. _____

ACTIVITIES

1. Discuss: The events that take place in each of the strokes of the two-cycle engine and how they are accomplished.
2. Discuss: How intake and exhaust take place on a two-cycle engine.
3. Discuss: The reason the fuel mixture rushes into the cylinder during the intake stroke.
4. List: The advantages of the two-stroke cycle engine.
5. _____
6. _____

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 13-14.

UNIT 8

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Principles of Operation - Comparing the two and four-cycle engines.

OBJECTIVES

1. The pupil will list four main differences between the two and four-cycle engine.
2. The pupil will explain the differences between lubrication of the two engines.
3. The pupil will list (or point out) the outward features that distinguish a two-cycle engine from a four-cycle engine.
4. The pupil will list the criteria in selecting the proper type and size of engine.

ACTIVITIES

1. List: Engine parts that are the same on both types of engines.
2. List: The parts of each type engine that are different.
3. Discuss: The differences in operation of the two engines.
4. Discuss: Advantages and disadvantages of each of the engines.

MATERIALS

Book: "Small Gas Engines", Alfred C. Roth, Goodheart-Willcox, South Holland, Ill., 1975, p. 34 (Chart comparing 2-4 cycle engines)

UNIT 9

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Principles of operation - Rotary Engine.

OBJECTIVES

Given a cut-away drawing of a rotary engine,

1. The pupil will be able to explain the operating principle of the rotary engine.
2. The pupil will be able to compare the operation of the rotary engine to the piston engine.
3. The pupil will list advantages and disadvantages of the rotary engine over the piston engine.

ACTIVITIES

1. Distinguish: The rotary engine compared to others.
2. List: The parts of the rotary engine.
3. Assemble: A plastic model of a Wankel engine.
4. Visit: A local dealer of rotary engines, such as an outboard engine, snowmobile, or automobile dealer. Ask to look over the engine and have a demonstration.

MATERIALS

Book: "Small Gas Engines", Alfred C. Roth, Goodheart-Welch Co., South Holland, Ill., 1975.

UNIT 10

Small Gasoline Engines, Operation, Construction, Care and Maintenance.

Operation and Servicing - Identifying Information.

OBJECTIVES

Given a lawn mower or small engine,

1. The pupil will correctly identify the manufacture, Model, type (if available) serial number, Horsepower, and whether it is a two or four-cycle engine.

2. The pupil will correctly identify the purpose of the engine. What it will be used for (ex. lawnmower, snowblower).

3. The pupil will record information about the positioning of the crankshaft (horizontal or vertical).

4. The pupil will check over the engine and try starting the engine and record the outcome.

ACTIVITIES

1. Discuss: The need for recording information to replace parts and in the event the mower is stolen.

2. Discuss: Important points in starting engine:
   1. Check gas
   2. Check oil
   3. Positioning of feet
   4. Keep others away
   5. Correcting setting for gas and choke

3. Troubleshoot: Have each student or group of students try starting engines and the rest of the class observe and list their predictions of to the problem with the engine.

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 19-21.

UNIT 11

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operations and Maintenance - Cleaning Small Engines (Cooling Systems).

OBJECTIVES

Given a small engine and necessary equipment.

1. The pupil will point out and name the parts that are involved in cooling the engine.
2. The pupil will demonstrate the function of the parts involved in cooling the engine.
3. The pupil will list the reasons for cleaning the outside of the engine.
4. The pupil will clean and inspect the crankcase, cooling system, and accessories of the engine.

ACTIVITIES

1. Discuss: The theory of the cooling fins.
2. Illustrate: The use of the shrouds and baffles and its purpose in directing air flow.
3. List: Twelve tools needed to remove shrouding and muffler to clean the outside parts of the engine.
4. Discuss: Materials to use for cleaning their engine (solvents, steam, etc.) empnasizing safety conditions.
5. Clean: The fins and shrouding by first removing air deflector, cylinder baffle, cylinder head baffle, and blower shroud.
6. Clean: Exhaust system.
7. Clean: Flywheel fins.
8. Reassemble: In reverse order and run from 3 to 5 minutes.
9. Discuss: Safety rules while working with solvents, around moving engine, and while working with engines with gasoline.

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 21-32.
Parma Schools Safety Program.

UNIT 12

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Servicing Carburetor Air Cleaners.

OBJECTIVES

Given three different examples of air cleaners and the air cleaners on the student's engine,

1. The pupil will identify the bath type, the oil filter type, and the dry-filter type.
2. The pupil will describe how the different types work.
3. The pupil will list the reasons it is important to service the air cleaners at regular intervals.
4. The pupil will identify the type air filter on his own engine.
5. The pupil will remove and correctly service his air filter.

ACTIVITIES

1. Discuss: The advantages and disadvantages of the different types.
2. Discuss: Results of a dirty air filter to the performance of the engine.
3. Discuss: Harmful results to the engine from a dirty or clogged air filter.
4. Demonstrate: The principle of each of the filters.
5. Discuss: When to clean the air filters.
6. List: Tools and materials needed to service air filters.
7. Demonstrate: Correct procedures for servicing each of the different types of air filters.

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 32-43.

UNIT 13

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Servicing Fuel Strainers.

OBJECTIVES

Given three different drawings of fuel strainers and the fuel strainer on the pupil's own engine.

1. The pupil will identify the three different types of fuel strainers.
2. The pupil will describe how the different types function.
3. The pupil will list the reasons for servicing the fuel strainers.
4. The pupil will identify the type of fuel strainer used on his engine.
5. The pupil will remove and correctly service or replace his own fuel strainer.

ACTIVITIES

1. Discuss: The purpose of the fuel strainer.
2. Demonstrate: The different kinds of fuel strainers and principle of each.
3. Discuss: Advantages and disadvantages of the different types of fuel strainers.
4. Discuss: Importance of servicing fuel strainers.
5. List: Tools and materials needed.
6. Demonstrate: Correct procedure for servicing each of the different types of fuel strainers.

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 44-49.

UNIT 14

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Servicing Crankcase Breathers.

OBJECTIVES

Given a drawing of the three types of valves used in crankcase breathers, and the one on the student's own engine,

1. The pupil will identify the three different types of valves.
2. The pupil will describe how the different types function.
3. The pupil will list the reasons for servicing the crankcase breathers.
4. The pupil will identify the type crankcase breather on his own engine.
5. The pupil will check the crankcase vacuum.
6. The pupil will service the crankcase breather on his own engine.

ACTIVITIES

1. Discuss: The purpose of the crankcase breather.
2. Demonstrate: The three different types of crankcase breathers.
3. Distinguish: Different indicators that the crankcase breathers may need servicing.
4. Demonstrate: Procedures for determining if crankcase breathers need servicing and the procedures in servicing.

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 50-56.

UNIT 15

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Lubricating Small Engines.

OBJECTIVES

Given drawings of four different methods by which oil gets to the bearing surfaces on a four-cycle engine,

1. The pupil will identify each of the four methods.
2. The pupil will explain the principles of each method.

ACTIVITIES

1. Discuss: Four different methods of lubricating the four-cycle engine.
2. Demonstrate: How each of the methods operate.

OBJECTIVES

3. The pupil will explain the principle of lubricating the two-cycle engine.
4. The pupil will list the reasons for properly lubricating a small engine.
5. The pupil will check the oil level on his own engine to see if it is properly filled.
6. The pupil will correctly drain the oil from his own engine.
7. The pupil will select the best oil for his engine and fill properly.

ACTIVITIES

3. Discuss: Lubrication of the two-cycle engine.
4. Discuss: The importance of correct lubrication.
5. Discuss: API service classifications and SAE viscosity-grades of oil.
6. Discuss: Additives, detergents, single-viscosity, and multi-viscosity oils.
7. Demonstrate: Correct procedures in checking oil level, draining the oil, and refilling the oil reservoir.

UNIT 15 (cont.)

MATERIALS

Book: "Small Gasoline Engines", Vol. 1, AAVIM, pp. 57-68.

UNIT 16

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Fuels, Selection, Use, and Storage.

OBJECTIVES

1. The pupil will list factors to consider in selecting the correct fuel and storing fuel.
2. The pupil will explain the correct procedure for preparing fuel for the two-cycle engine.
3. The pupil will list the factors to consider in filling the fuel tank.

ACTIVITIES

1. Discuss: Octane ratings, low lead, high test, and regular gas, and which is best for small engines.
2. Assign: Special reports of refining to understand the gas purchased at the pump.
3. Discuss: Winter gasoline and why it is bad for small engines.
4. Demonstrate: Safe practices in handling gasoline.
5. Discuss: Examples of accidents, that the teacher or the students know about, that occured because of careless handling of gasoline.

MATERIALS

Book: "Small Engines", Vol. 1, AAVIM, pp. 68-73.

UNIT 17

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Servicing Spark Plugs and Ignition Systems.

OBJECTIVES

Given a drawing of the parts of the ignition system,

1. The pupil will explain the construction and function of the magneto, coil, condensor, breaker points, breaker cam, and the spark plug.

2. The pupil will explain and trace the cycle of events that take place in the ignition system from the magneto to the spark plug.

ACTIVITIES

1. Discuss: The different parts and their function using a cut-away model of a small engine.

2. Experiment: With a coil of wire and a magnet to induce a current. Use a galvanometer to show the current flow.

3. Note: The basic ignition system only is being discussed here. More detailed information can be found in Unit 23 - Operation and Repair Ignition Systems.

OBJECTIVES

Given examples of several different types of spark plugs and the plug in the students own engine,

3. The pupil will distinguish between the hot plug and the cold plug, and explain the difference.

4. The pupil will select the correct type for replacing the plug in his own engine.

5. The pupil will explain the importance of servicing or replacing the spark plug.

6. The pupil will check the spark plug for proper operation on his own engine.

7. The pupil will correctly clean and gap the spark plug on his own engine.

8. The pupil will correctly install the spark plug in his own engine.

Unit 17 (cont.)

ACTIVITIES

1. Section: A spark plug, so that the inner construction can be studied.

2. Discuss: The different types of spark plugs and where each of the types may be used.

3. List: Problems that occur with a spark plug needing service.

4. Demonstrate: The correct procedure and tools for:
   a. removing the spark plug.
   b. checking the spark plug.
   c. cleaning the spark plug.
   d. setting the gap of the spark plug.
   e. installing the spark plug.

MATERIALS

Book: "Small Engines," Vol. 1, AAVIM, pp. 74-85.

UNIT 18

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Checking and Adjusting Carburetors (Fuel System).

OBJECTIVES

Given a drawing of a small gas engine fuel system,

1. The pupil will identify the carburetor, fuel tank, fuel line, air cleaner, fuel pump choke and governor.

2. The pupil will explain the function of each part.

ACTIVITIES

1. Demonstration: Using a fully assembled engine, have the students trace the flow of fuel and identify the parts of the fuel system.

2. List: The basic parts of the fuel system.

3. Demonstrate: With an operating engine, how the governor maintains speed and will not allow the throttle to open to "full."

OBJECTIVES

Given a drawing or picture of a gravity feed carburetor and the suction feed system,

3. The pupil will distinguish between the two systems and explain the difference.

ACTIVITIES

1. Demonstrate: The principle and the difference of the two systems.

2. List: The advantages and disadvantages of each system.

3. Discuss: The conditions when one system would be preferred over the other.

OBJECTIVES

Given a diagram of a diaphram type of a carburetor,

4. The pupil will explain its operation and uses.

UNIT 18 (cont.)

ACTIVITIES

1. Discuss: The parts and the operation of the diaphram type of carburetor.

2. Discuss: The advantages of the diaphram type carburetor over the others.

OBJECTIVES

Given a diagram of a carburetor,

5. The pupil will identify the venture, throttle valve, float, needle valve, and the choke.

6. The pupil will be able to explain each part.

7. The pupil will define and describe the principles of carburation.

8. The pupil will be able to define and explain atomization.

9. The pupil will correctly disassemble and re-assemble the carburetor.

ACTIVITIES

1. Discuss: The parts of the carburetor and their function using a transparency and/or disassembled carburetor.

2. Demonstrate: The action of a carburetor with an atomizer or insect sprayer.

3. Demonstrate: With an engine operating, how to set a carburator for maximum power.

4. Demonstrate: With an operating engine, how "too lean" or "too rich" mixture affects operation and acceleration.

5. Demonstrate: Correct procedures for disassembling, cleaning, and reassembling the carburetor.

MATERIALS

UNIT 19

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Checking Compression.

OBJECTIVES

Given a small engine,

1. The pupil will list the reasons that good compression is needed for starting and operating the engine.
2. The pupil will perform the operations needed to check the compression on his own engine.
3. The pupil will list probable causes of poor compression.

ACTIVITIES

1. Discuss: The need for good compression in a small engine.
2. Demonstrate: Correct procedures for checking compression on the two and four-cycle engines.
3. Demonstrate: Methods of improving the compression.

MATERIALS

Book: "Small Engines," Vol. 1, AAVIM, pp. 110.

UNIT 20

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Checking and Servicing Batteries.

OBJECTIVES

Given a storage battery, and a cut-away drawing,

1. The pupil will list the parts of the battery.
2. The pupil will explain the principles of the operation of a battery.
3. The pupil will list the reasons for servicing the battery.
4. The pupil will check and service a battery.

ACTIVITIES

1. Discuss: The parts of a battery using a wall chart or transparency.
2. Discuss: The change inside the battery when it is charged or dis-charged.
3. Demonstrate: Correct procedures in checking and servicing a battery.
4. Discuss: Safe practices and procedures in working with a battery.

MATERIALS

Book: "Small Engines," Vol. 1, AAVIM, pp. 111-123.

UNIT 21

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Starting the Engine.

OBJECTIVES

Given a lawn mower or other machines with a small engine,

1. The pupil will list all precautions that must be taken before attempting to start the engine.
2. The pupil will start the engine.

ACTIVITIES

1. Discuss: Steps necessary in preparing to start an engine.
2. Demonstrate: By having a student perform all the necessary steps.
3. Demonstrate: Correct and safe steps in starting an engine.

MATERIALS

Book: "Small Engines," Vol. 1, AAVIM, pp. 124-132.

UNIT 22

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Operating the Engine (Adjustment).

OBJECTIVES

Given a small engine that is running,

1. The pupil will list the effects on the engine by over speeding and overloading.
2. The pupil will list six proper and safe conditions in operating the engine.
3. The pupil will demonstrate correct procedures for stopping the engine.

ACTIVITIES

1. Demonstrate: By having a student start and run an engine the same way he would have at home. (Watch for any incorrect operating or safety procedures.)
2. Discuss: The procedures of the pupil above.
3. Demonstrate: By having the same pupil, or another review the procedures.

MATERIALS

Book: "Small Engines," Vol. 1, AAVIM, pp. 134-139.

UNIT 23

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Maintenance - Storing Engines.

OBJECTIVES

Given a small engine or lawn mower,

1. The pupil will list the steps that should be taken for storing a small engine.
2. The pupil will identify the problems that can occur from improper storage.
3. The pupil will correctly prepare his own engine for storage.

ACTIVITIES

1. Discuss: The importance of proper storage.
2. Discuss: Problems that the pupil or his father has had in the Spring trying to start the lawnmower.
3. Visit: A lawnmower repair shop, especially in the Spring to see the many mowers lined up for service, mostly because of improper storage.

MATERIALS

Book: "Small Engines," Vol. 1, AAVIM, pp. 140-144.

UNIT 24

Small Gasoline Engines, Operation, Construction, Care, and Maintenance.

Operation and Repair - Starters.

OBJECTIVES

Given an illustration of the tree common starters,

1. The pupil will explain the function of the starters.
2. The pupil will identify and distinguish between the different starters.
3. The pupil will list advantages and disadvantages of the different types of starters.
4. The pupil will demonstrate the principles of the rope-wind.
5. The pupil will check and repair if necessary, the starter on his own engine.

ACTIVITIES

1. Discuss: The function of the starter and the different types of starters available.
2. Demonstrate: The procedures in checking and repairing the:
   1. Rope-wind starter
   2. Rope re-wind starter
   3. Wind-up starter
3. Discuss: Safety procedures in working with the starter as:
   1. disconnecting spark-plug wire
   2. caution in working with the recoil spring.

MATERIALS

Book: "Small Engines," Vol. 2, AAVIM, pp. 8-28.

UNIT 25

Small Gasoline Engines, Operation, Constr ıction, Care, and Maintenance.

Operation and Repair - Ignition System.

OBJECTIVES

Given examples of three types of ignition systems (1. magneto, 2. battery ignition, and 3. solid state ignition) and the ignition system on the pupil's own engine.

1. The pupil will explain the purpose of the ignition system.
2. The pupil will identify the different types of ignition systems.
3. The pupil will explain the principles of operation of the three different ignition systems.
4. The pupil will list procedures for determining the efficiency of the ignition system.
5. The pupil will check the magneto (Ignition system) on his own engine and determine if it needs servicing.
6. The pupil will correctly remove the breaker-point assembly from his own small engine.
7. The pupil will correctly check the operation of the condensor and determine its condition and replace if necessary.
8. The pupil will correctly adjust the breaker-point gap.

ACTIVITIES

1. Experiment: With a coil of wire and a magnet to induce a current. Use a galvanometer to show the current flow.
2. Make: A visible magneto mounted on a display board or built into a clear acrylic box so it can be manually turned with a crank.
3. Section: An old ignition coil to show the primary and secondary windings around the coil.
4. Demonstrate: Removing and schocking the flywheel to get how it works.
5. Demonstrate: By disassembling a magneto and demonstrate how it works.
6. Demonstrate: Checking and servicing or replacing the breaker-point assembly.

UNIT 25 (cont.)

7. Discuss: Testing the solid state ignition system.

MATERIALS

Book: "Small Engines," Vol. 2, AAVIM, pp. 45-76.

UNIT 26

Small Gasoline Engines, Operation, Construction, Ca. , and Maintenance.

Operation and Repair - Fuel Systems.

OBJECTIVES

Given the fuel system on the students own engine,

1. The pupil will describe the parts making up the fuel tank assembly.
2. The pupil will check and correctly clean up the fuel tank.
3. The pupil will check for leaks on his own fuel tank and if necessary, (and possible) he will repair them.

ACTIVITIES

1. Review: The parts of the fuel system and their function. (Materials covered in Unit 18).
2. Review: The three main types of fuel systems.
3. Discuss: Way of preventing a "Dirty" fuel tank.
4. Demonstrate: The correct procedure for cleaning the fuel tank.
5. Demonstrate: The correct procedure for fixing leaks in the fuel tank.
6. Review: Safe procedures while working with gasoline.

OBJECTIVES

Given the student's own small gasoline engine with a floater suction lift carburetor,

4. The pupil will remove the carburetor from his engine.
5. The pupil will repair (or disassemble and re-assemble) the carburetor on his own engine.
6. The pupil will re-install the carburetor on his own engine.

ACTIVITIES

1. Review: The information on types of carburetors and their operation in Unit 18.
2. Demonstrate: Removing the carburetor from the engine.

UNIT 26 (cont.)

3. Sketch: Have pupil sketch the governor and throttle connections so that it can be re-assembled the correct way.

4. Demonstrate: The correct procedures for checking and repairing the float type carburetor.

5. Demonstrate: The correct procedure for checking and repairing the suction-lift carburetor.

6. Demonstrate: The correct procedure for installing the carburetor.

7. Demonstrate: The correct procedures for repairing governors.

MATERIALS

Book: "Small Engines," Vol. 2, AAVIM, pp. 86-107.